

Hyperloop: Private or Public Infrastructure?

(<http://oppositelock.jalopnik.com/hyperloop-private-or-public-infrastructure-1486200981>)



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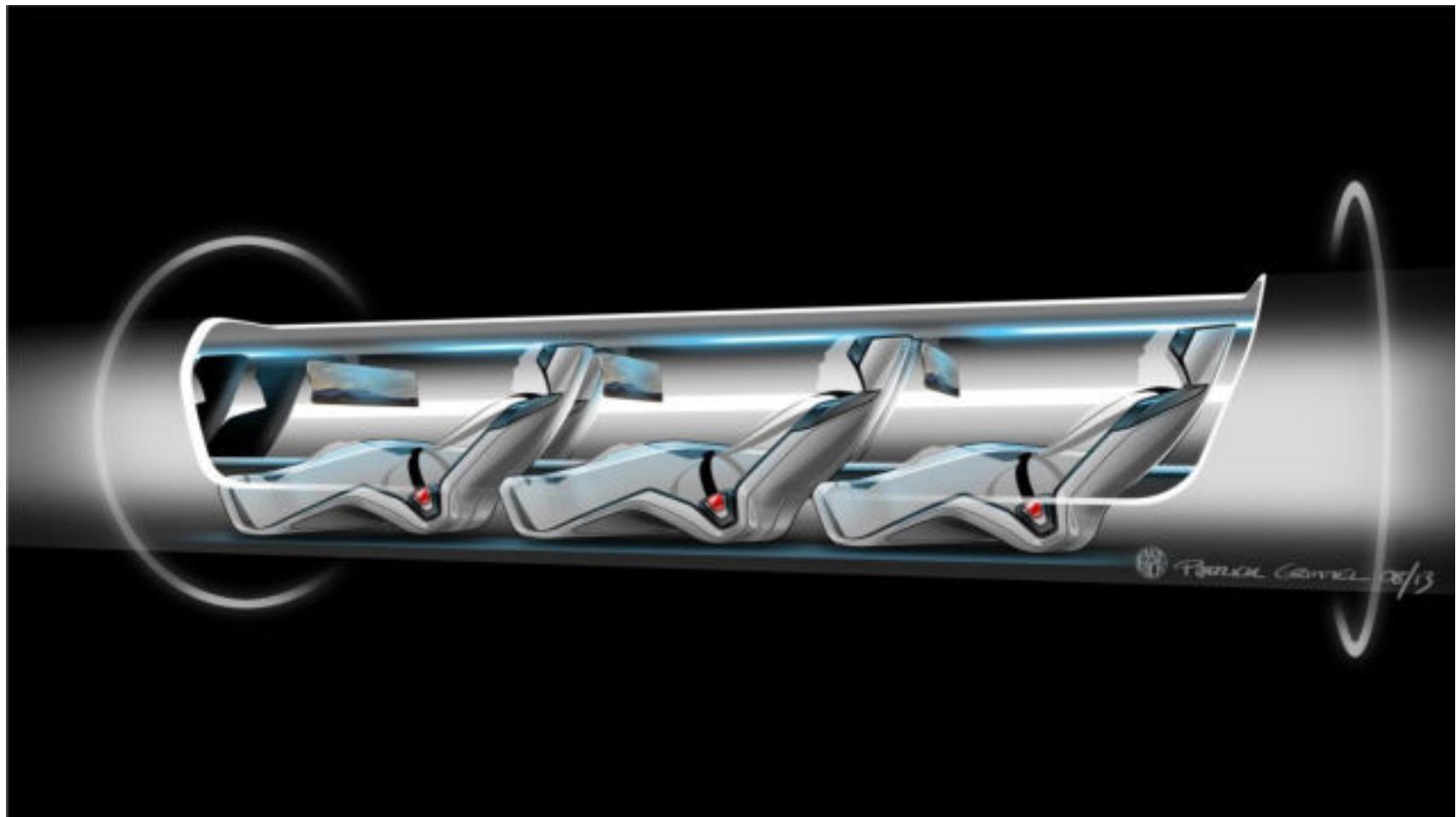
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Filed to: ECONOMICS (/TAG/ECONOMICS) 12/19/13 8:20pm (<http://oppositelock.jalopnik.com/hyperloop-private-or-public-infrastructure-1486200981>)



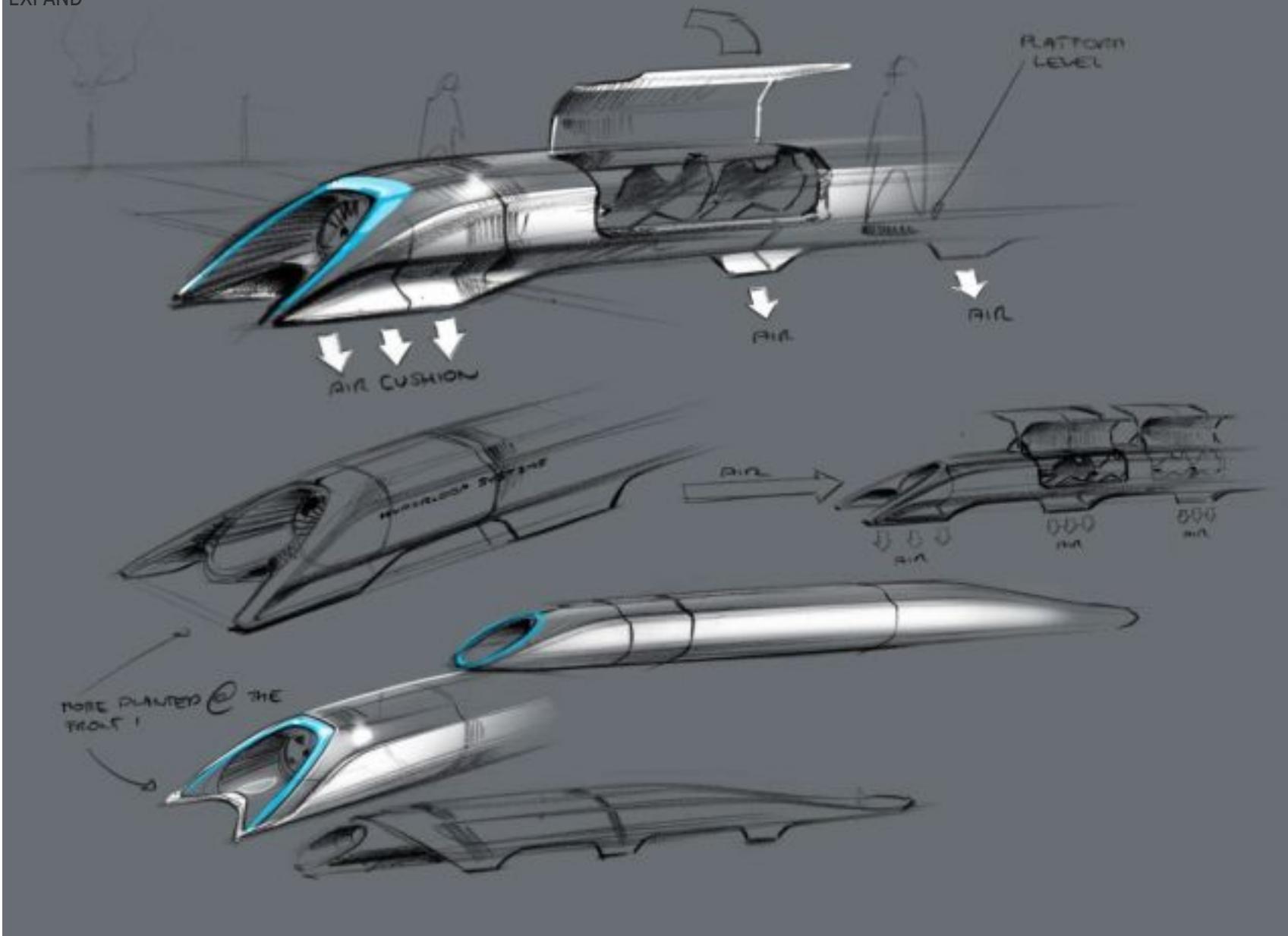
The Hyperloop was recently introduced by Elon Musk as an alternative to the Californian High Speed Rail Authority's \$68 billion dollar proposal for a new high-speed rail linking San Francisco and Los Angeles that, so far, has only secured about 1/6th of the necessary funding for construction. Due to Elon Musk's desire for the Hyperloop transportation system to be crowdsourced, many may speculate that the system will be introduced as a public good; however, this may not be the best scenario for the social benefit of society.

The Hyperloop is an idea for a transportation system comprised of multiple capsules traveling through a contained low-pressure environment proposed by Elon Musk, founder of Tesla and SpaceX, in place of the planned California High-Speed Rail. The capsule, "features a compressor at the leading face to ingest oncoming air for levitation and to a lesser extent propulsion

(http://www.spacex.com/sites/spacex/files/hyperloop_alpha.pdf)". Levitation of the Hyperloop capsule occurs from the expulsion of compressed air from the bottom of the capsule rather than electromagnetic levitation because of the higher initial costs and running costs associated with an electromagnetic system. Rail support is also not an option due to the extensive "frictional losses" (http://www.spacex.com/sites/spacex/files/hyperloop_alpha.pdf) that would require a more sufficient onboard engine and ultimately demise the project to no more than smaller contained locomotive. The onboard compressor creates lift as well as maintains speed. For acceleration and deceleration, a series of electromagnetic arrays both push the capsule during departure and acceleration and also capture the energy to recycle back into the system from deceleration rather than wasting energy during traditional braking. Top speed for the Hyperloop system is 760 miles per hour, "for aerodynamic considerations (http://www.spacex.com/sites/spacex/files/hyperloop_alpha.pdf)," and the gravitational load on the capsule and its passengers, both in acceleration and horizontal loading, does not exceed .5 G as it, "is deemed the maximum inertial acceleration that can be comfortably sustained by humans for short periods

(http://www.spacex.com/sites/spacex/files/hyperloop_alpha.pdf). Filling these constraints, the Hyperloop transportation system would be able to, "transport people, vehicles, and freight between Los Angeles and San Francisco in 35 minutes

(http://www.spacex.com/sites/spacex/files/hyperloop_alpha.pdf). The summation of passengers the Hyperloop would be able to transport each year would amount to 7.4 million. The total estimated cost of the human transportation project is \$6 billion, although some have estimated this number to be off by tens of billions.



Individual passengers on any journey attach different values to their trips that vary based on multidimensional perceptions of how their journey is affecting their time as well as the time of those around them; this variation in valuation can predict what form of transport a traveler will consume for a particular journey. Below are predicted cost equations for four substitute forms of transportation, where x is the individual's valuation of 1 hour of their time, λ_i is the individual's perception of safety, β_i is the individual's desired freedom, ρ_i is the individual's altruistic beliefs concerning Climate Change, and ω_i is the individual's desire for technological advancement and futurism in society.

$$\text{Airplane} = \$58 + 2x + \lambda_1$$

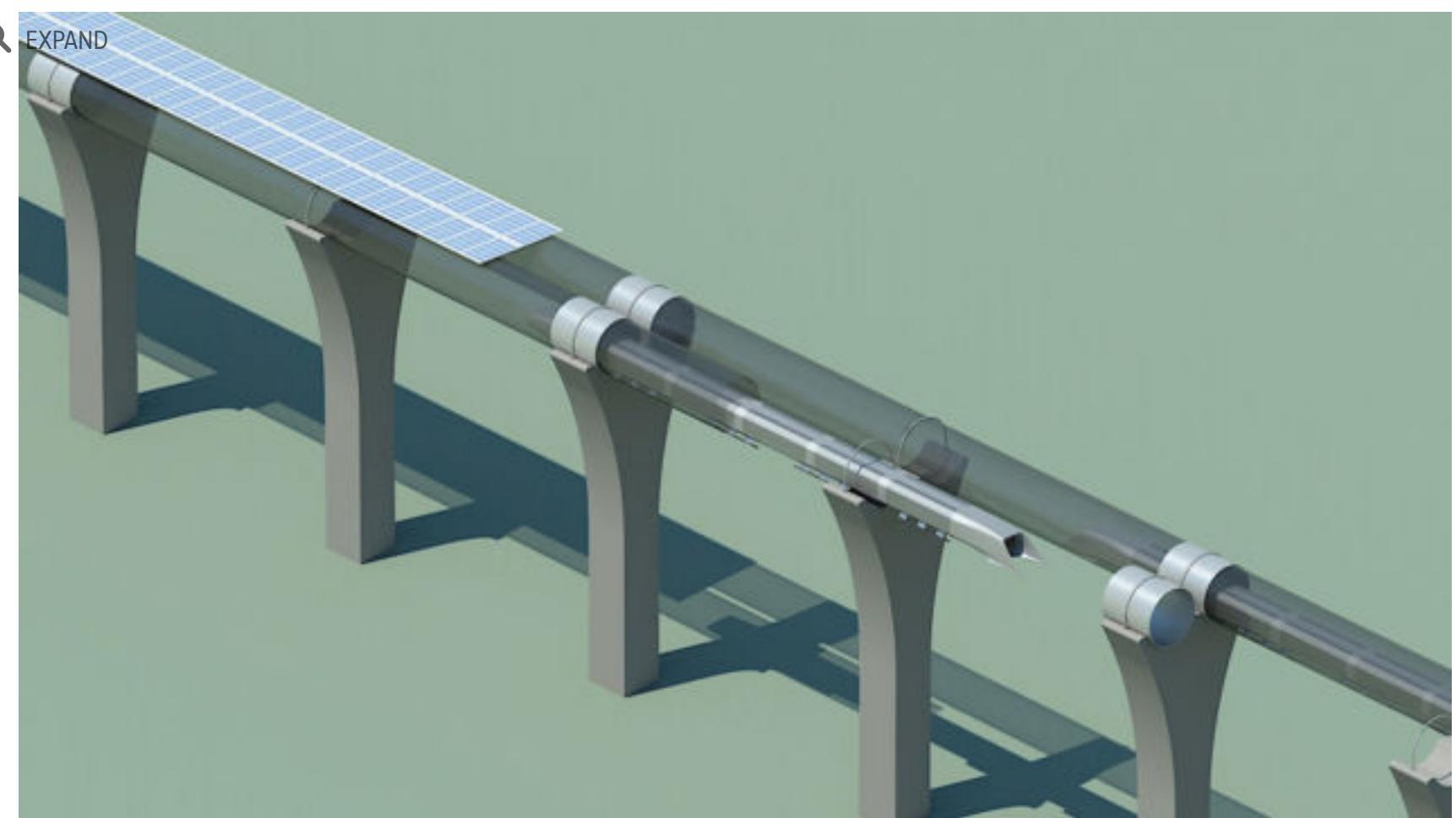
$$\text{Automobile} = \$45.72 + 5.33x + \lambda_2 - \beta_2$$

$$\text{High Speed Rail} = \$105 + 2.67x + \lambda_3 - \beta_3 - \rho_3$$

$$\text{Hyperloop} = \$a + .583x + \lambda_4 - \rho_4 - \omega_4$$

β_i was not included for either an Airplane or Hyperloop journey because there are no stops or changes within the route, and thus $\beta_1, \beta_4 = 0$. Assuming an individual just wants to get from San Francisco to Los Angeles, or vice versa, without any stops ($\beta_i = 0$), an airline would be the most direct substitute a consumer would have for the Hyperloop.

If either a publicly funded Hyperloop or High Speed Rail is introduced into society as an option of transportation, the airlines running between San Francisco and Los Angeles will be crowded-out of the market (<http://www.investopedia.com/terms/c/crowdingouteffect.asp>), possibly to the extent of creating a natural monopoly for the land based competitor. Not only will a land-based high-speed transport system crowd-out airline alternatives, but some automotive travelers with a particular valuation of freedom (β_i), who would not have before justified the opportunity cost of an airplane's lack of freedom, would choose to instead take the Hyperloop or High Speed Rail and rent a car at their destination.



If the desire to revert Climate Change (ρ_i) and the desire to increase technological advancement and futurism (ω_i) in society by the people of California was high enough, the justification for a publicly funded Hyperloop would be enough to account for its construction. Californian voters agreed on their desire to fight Climate Change and offer an alternative to airlines, "when California voters approved Proposition 1A in 2008 (<http://www.forbes.com/sites/markrogowsky/2013/08/12/hyperloop-the-high-cost-and-long-journey-of-californias-rail-project/>)"; this proposition, "allocated nearly \$10 billion of an estimated \$45 billion to build a train from San Francisco to Los Angeles

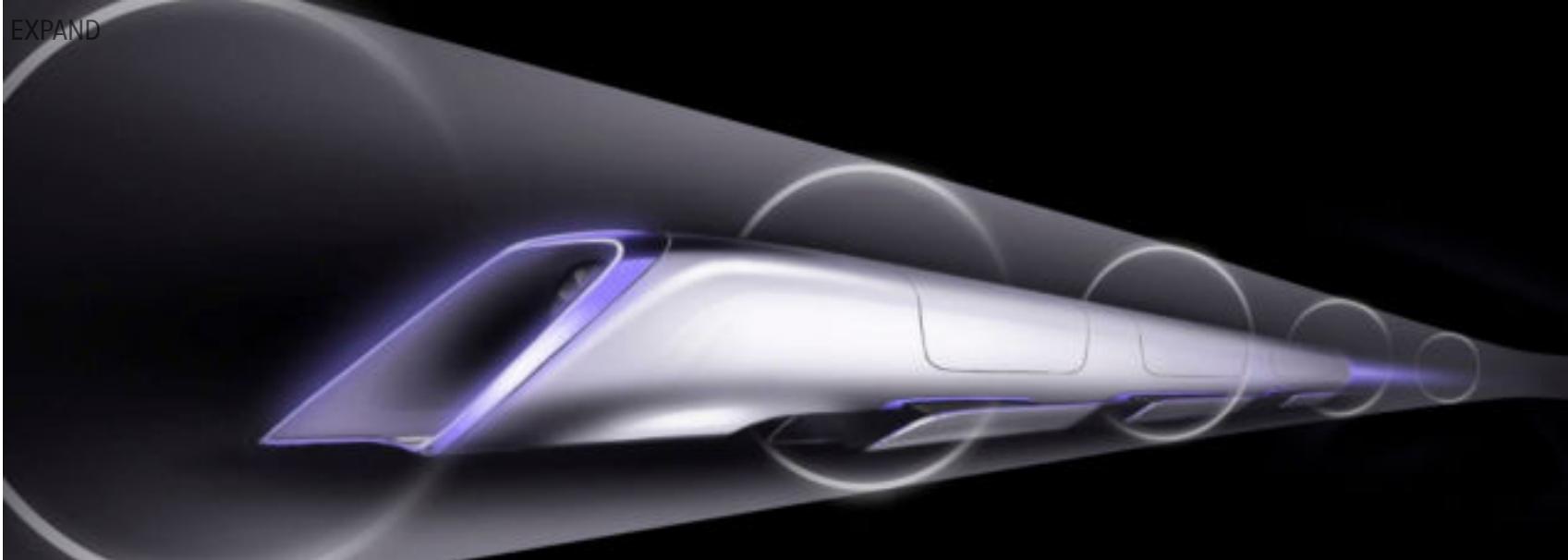
(<http://www.forbes.com/sites/markrogowsky/2013/08/12/hyperloop-the-high-cost-and-long-journey-of-californias-rail-project/>). The \$10 billion dollar valuation of reversing Climate Change through offering a new form of transportation would be enough to fund a Hyperloop system between the two major Californian cities, assuming the correct initial cost of constructing such a system would amount to just \$6 billion, and would even be enough to fund the system's operating costs with the \$4 billion left over, as long as an assumed constant operational cost is less than \$120 million each year with an assumed annual interest rate of 3%.

The public's valuation of a new High Speed Rail included the train's affect on Climate Change, but it also included almost no effect on technological advancement and futurism (ω_i), therefore a public valuation of a Hyperloop would be greater than voters' \$10 billion approval of Proposition 1A. Elon Musk's desire for technological advancement and futurism in society (ω_i) by way of introducing the Hyperloop was so high that he decided to give the idea away and crowdsource the Hyperloop without any possibility of a direct monetary benefit though its construction.

Because of the nature of extensive public infrastructure, such as highways, roads, airports, and railroads, to be relatively non-excludable public goods, firms can sell more efficient tools, such as bikes, cars, airplanes, airplane tickets, and train tickets, to the consumer for traversing such infrastructure in a relatively competitive manner to where if the rivalry

(http://www.investopedia.com/terms/r/rival_good.asp) of transportation increases, the competitive market will generally respond with an increase in supply of tickets. If the Hyperloop was expected to reach a level of adoption to the point of expanding throughout the country, wherein the level of available freedom for a passenger (β_i) would also increase, a publicly funded tubing and station network would benefit society through its comparative efficiency relative to multiple firms building multiple competing Hyperloops to traverse the same distance. However, the Hyperloop is still completely new and undiscovered technology that will only begin by traversing two locations and will require a large amount of communication between each capsule and the tubing network. Creating a completely public Hyperloop system would crowd-out other forms of transportation to the point where the rivalry between consumers for the Hyperloop would escalate beyond the point of non-excludability. Since the government is not able to enlist a Lindahl pricing

(<http://www.investopedia.com/terms/l/lindahl-equilibrium.asp>) strategy, where the consumers respond honestly and pay exactly for how much they value the Hyperloop, in order to pay for the Hyperloop, some consumers that value a journey via the Hyperloop more than others may be excluded from partaking and will thusly become an inefficiency of the transportation network.



The Hyperloop is a theoretical invention of Elon Musk that utilizes a low-pressure environment to transport capsules across a distance. Individuals value different modes of transport based on how those modes affect their time as well as the time of the people they surround; aggregating these values and comparing them to new forms of transport can determine how a society will value construction of a new system. A purely public induction of a Hyperloop system will crowd-out airlines and traditional rail as airline and rail transport are not fast enough to keep up with the Hyperloop's speed. The non-excludable nature of public infrastructure allows firms to sell more efficient tools for traveling across this infrastructure, yet the Hyperloop's infrastructure will not be comparatively extensive for a considerable period of time.

I would recommend a private corporation's induction of the Hyperloop system between San Francisco and Los Angeles until the system reaches a point of viability for national expansion wherein the network be publicly funded, while the capsules are privately owned.

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Fractal Footwork's Discussions (<http://oppositelock.jalopnik.com/hyperloop-private-or-public-infrastructure-1486200981>)

All replies (<http://oppositelock.jalopnik.com/hyperloop-private-or-public-infrastructure-1486200981/all>)



[shpuker \(<http://shpuker.kinja.com>\)](http://shpuker.kinja.com) ▶ Fractal Footwork
[12/19/13 8:34pm \(<http://oppositelock.jalopnik.com/the-absence-of-logic-in-this-idea-is-pretty-astounding-1486200981>\)](http://oppositelock.jalopnik.com/the-absence-of-logic-in-this-idea-is-pretty-astounding-1486200981)

The absence of logic in this idea is pretty astounding. Is it possible? Yes. Is it efficient? Hell no. Is it practical? Hell no.

Hell if you really want that train up and going, hire the Japanese engineers responsible for their bullet train to come over and wreck house. Hell they could probably get it done for the \$10 million already put together.

That said, it is a neat concept. Just massively impractical and labor intensive to put together.



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[12/19/13 8:39pm \(http://oppositelock.jalopnik.com/the-absence-of-logic-in-this-idea-is-pretty-as \(http://fractalfootwork.kinja.com\)\)](#)

The absence of logic in this idea is pretty astounding. Is it possible? Yes. Is it efficient? Hell no. Is it practical? Hell no.

Well, it's still a concept...

I just think it's effect on society is too important to be overlooked by some decades-old technology.



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[12/19/13 9:20pm \(http://oppositelock.jalopnik.com/fair-enough-but-as-far-as-being-put-into-action-im-r \(http://shpuke.kinja.com\)\)](#)

Fair enough. But as far as being put into action? I'm not feeling nearly as confident as Musk. The whole, "The total estimated cost of the human transportation project is \$6 billion, although some have estimated this number to be off by tens of billions." part is a bit off putting. Sounds like the typical Musk approach of, "Ohh it'll only cost \$6 billion!" and then once all is said and done the project has sucked a good \$60 billion down the hyper tube.



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[12/19/13 9:32pm \(http://oppositelock.jalopnik.com/yeah-his-estimation-is-almost-certainly-off-14 \(http://fractalfootwork.kinja.com\)\)](#)

Yeah, his estimation is almost certainly off.



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[12/19/13 9:44pm \(http://oppositelock.jalopnik.com/the-optimism-is-nice-but-a-little-realism-would-certa \(http://shpuke.kinja.com\)\)](#)

The optimism is nice, but a little realism would certainly help take it seriously. It'd be interesting to have someone give an external estimate on this to see what they think the cost would be closer to.

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[12/20/13 12:41am \(<http://oppositelock.jalopnik.com/tech-and-efficiency-aside-my-little-brain-is-keening-a-148699>\)](#)
(<http://orcim.kinja.com>)

Tech and efficiency aside, my little brain is keening at the relative effort of this, and realizing that there isn't a single private corporation with the balls, leadership or financial ability to get this done, imo. All the other factors don't matter in that case.

Every initial large scale tech has had some kind of public support (or so I believe, examples to the contrary are welcome.) Loan guarantees at the least, and fully funded at the worst. Not to mention that I think it would take some eminent domain to handle some of the problems this brings up just in easements and rights of way - and private can't deal with that.

That said, it's appropriate for public funding to help out, because that's what it's there for, to cover those issues associate with our current private funding inabilities.

My 2 cents, could be completely blind here, but welcome the discussion.

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[12/20/13 7:39am \(<http://oppositelock.jalopnik.com/no-doubt-i-assumed-a-lot-to-come-to-this-cc>\)](#)
(<http://fractalfootwork.kinja.com>)

No doubt I assumed a lot to come to this conclusion, but I do think it is possible for a private corporation to achieve this with some government cooperation.

It's just that, to get anything this technologically advanced constructed as a public good is getting increasingly difficult. I think loans or grant money would be a great possible solution by the public to get this ball rolling, both in research and deployment.

Speaking of 'balls', yeah, it's a risky investment, but the small scale research should see if it's actually a viable idea. The crowdsourcing may actually turn out to be more of a problem than Elon first suspected because all of the information is out there for anyone to compete as they'd like, forcing some companies with the money to initiate such a project to look past the idea as they would not be granted patent rights or a guaranteed monopoly.

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I predict that if this is viable, it happens in another country where they have a public sector
12/20/13 3:00pm (<http://oppositelock.jalopnik.com/i-predict-that-if-this-is-viable-it-happens-in-another-1487354144>)
willing to use a little control because their systems allow it that can give the boost needed to get it
done. Non of this invisible hand mono-value ca-ca, the real world is not a model or a theory.

Hmm.. I like your comment on the crowd sourcing, but I can point out that things have been
crowd sourced, but the IP is not. The tech doesn't have to be shared with everyone.



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[12/20/13 5:21pm](http://fractalfootwork.kinja.com) (<http://oppositelock.jalopnik.com/no-the-world-is-not-a-model-but-the-theorie>
(<http://fractalfootwork.kinja.com>))

No the world is not a model, but the theories apply and the model does translate if all the correct
real-world constraints are assumed.

Yeah, the government is standing a bit in the way of the land purchasing, since Elon want it to
follow the I5 most of the way and the government is forcibly able to purchase other land at its
'reasonable price'. A private sector firm would have to face a market instead of buying as a
monopsony.



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[12/20/13 5:32pm](http://orcim.kinja.com) (<http://oppositelock.jalopnik.com/i-think-if-all-the-correct-real-world-constraints-are-148>
(<http://orcim.kinja.com>))

I think "if all the correct real-world constraints are assumed" is where we'd have a difference of
opinion about this. Most notably, you can't model or theorize what you don't know about.

I'd love to see something like this project, though, even if it was a bit expensive (and finding a
good way to fund it.) The spinoffs would be great, but I wonder if the time savings promised over
airplanes wouldn't run into the TSA reality.



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[12/20/13 6:04pm](http://fractalfootwork.kinja.com) (<http://oppositelock.jalopnik.com/most-notably-you-cant-model-or-theorize-w>
(<http://fractalfootwork.kinja.com>))

"Most notably, you can't model or theorize what you don't know about."

Oh I beg to differ. Haha. I may be thinking different than you, but modeling something that they
didn't know anything about way how scientists discovered the Higgs boson.

I also just took econometrics and we model the error term regularly.

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[12/20/13 6:35pm \(<http://oppositelock.jalopnik.com/discovering-the-higgs-boson-was-not-discovering-but>
\(<http://orcim.kinja.com>\)](#)

"Discovering" the Higgs Boson was not discovering, but proving. It was a theory based on other knowledge - they didn't just find that particle randomly. Think of DDT - worlds greatest mosquito killer, it's gonna (and did) save thousands of lives every year from malaria. But what they didn't know about DDT hurt them.

Physics is bad enough for modeling - look how long it takes to change a "well known" fact when new evidence indicates that everything should change - decades. Econometrics is 10 times worse (in implementation.. the subject itself is hugely interesting to me.)

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